Addendum.—Received January 19, 1888.

The following table shows the above figures in another form and includes the bright lines recorded in γ-Cassiopeiæ :—

Aurora.	Dunér's bands.	Bright lines in γ-Cassiopeiæ.	Probable origin.	Wave-length of probable origin.
431	..	..	CH	431
474	460—474 (10)	..	C (hot)	474
..	..	462·3	Sr	460·7
483	477—485 (9)	..	C (cool)	483
500	495—503 (8)	499	Mg	500
516·5	516—521 (7)	516·7	C (hot)	516·5
520·1	..	..	Mg	520·1
531	..	531	Coronal line	
..	..	542·2	Mn	540
545	545—550 (5)	..	Zn (1)	546
558	559—564 (4)	555·7	Mn (1)	558
..	585—595 (3)	586	Mn (2)	586
615	616—627 (2)	616	Fe (1)	615
635	..	635·6	*	..

II. "On the Secondary Carpals, Metacarpals, and Digital Rays in the Wings of existing Carinate Birds." By W. K. Parker, F.R.S. Received January 11, 1888.

In a paper "On the Morphology of Birds," already sent in to the Royal Society, but not yet published, I have described certain additional parts in the wings of Gallinaceous birds.

One of these lies on the radial side of the first metacarpal; the other two are on the ulnar side of the second and third metacarpals.

These parts, which at first caused me considerable surprise, being wholly unexpected by me, are only part of what I have since found in other families.

During the past year I have worked out the development of the skeleton in the Duck tribe ("Anatidæ"), in the Auk tribe ("Alcidæ"), and in the Gull tribe ("Laridæ"), and to some degree in some other families. The subject appears to me to be of great interest, and I have, through various English and American friends, obtained many scores of embryos and young birds, &c., that I may be able to trace

* This line is seen as a pretty bright line in the spectrum of the Limerick meteorite, but its origin has not yet been determined, although comparisons have been made with most of the common elements. So far, it has not been observed in any other meteorite.

these parts in every main group of the Class. Normally, both the existing Carinatæ and Ratitæ, and such extinct forms as have been worked out—*Archæopteryx*, *Hesperornis*, *Ichthyornis*—show that the primary form of the bird's wing is simply *tri-digitate*. In this I agree with Baur, who has helped me greatly in this matter, both by his valuable papers and also by personal discussion with me.

The normal "manus" of a carinate bird contains two permanently distinct carpals: three carpals that lose their independence by ankylosis with the metacarpals, and three digital rays extending from the three fused metacarpals.

In some birds, *e.g.*, the Passerinæ, the *pollex* of the first digit has only one phalanx attached to its short metacarpal, the second only two, and the third only one, phalanx. In others, Plovers, Gulls, Cormorants, &c., an additional or *ungual* phalanx is found on the first and second digit; and in some birds, *e.g.*, *Numenius*, during their embryonic state, a small nucleus arm is seen on the end of the aborted phalanx of the third digit.

In my as yet unpublished paper I have mentioned a sub-distinct tract of very solid fibro-cartilage, which evidently corresponds with what has been called "præ-pollex" by Kehrer and others.*

I am satisfied, now, that this very notable part is the remnant of the skeleton of the *spur*, so remarkably developed in the Palamedidæ, certain Geese, Plovers, and Jacanas.

This part therefore need not interfere with the consideration of the *true secondary digital* parts.

Among the last communications received by me from Dr. Baur, I find in print what I had already learned from him orally.

In some "General Notes" published in the 'American Naturalist,' September, 1887, p. 839, I find the following paragraph: "The oldest Ichthyopterygia had few phalanges and not more than five digits; [the] radius and ulna were longer than broad, and separated by a space. Later, through the adaptation to the water, more phalanges were developed, more digits appeared, mostly by division of the former, or by new formation on the ulnar side. I have never found a new digit developed on the radial side."

These are most important facts, some of which, namely, the bifurcation of the digital rays, I had received some light upon, before, both from Dr. Gadow and from Professor D'Arcy W. Thompson.†

I find that the *carpus*, *metacarpus*, and digital rays are all apt to increase in number beyond what is normal.

* "Beiträge zur Kentniss des Carpus und Tarsus der Amphibien, Reptilien, und Säuger," 'Berichte der Naturforschenden Gesellschaft zu Freiburg i. B.,' vol. 1, 1886 (Heft 4 and Taf. 4).

† See his paper on the hind limb of Ichthyosaurus, &c., 'Journ. Anat. Physiol.,' vol. 20, 1886, pp. 532–535.

Long ago I found, in one of the Palamedidæ, *Chauna chavaria*, *two ulnar carpals*, apparently an "ulnare" proper, and "centrale." More recently in the embryo of a more normal Chenomorph—the Falkland Island Goose (*Chloëphaga policephala*) I found the ulnare nearly divided into two segments.

On the other side of the carpus in an embryo Kestrel (*Falco tinnunculus*) and in a young Sparrow-hawk (*Accipiter nisus*), I found a "radiale" in two pieces, the outer of which in the latter was degenerating into the large "os prominens" which is found in the tendon of the "tensor patagii" muscle of rapacious birds.

In the embryos of Gulls, Auks, Guillemots, &c., the large "distal carpal" of the index or second digit sends forward a long wedge of cartilage towards an additional metacarpal nucleus. Evidently this is the rudiment of another carpal seeking to be attached to its own intercalary metacarpal.

Further on, on the large second digit, the flat dilated part of the proximal phalanx, on its ulnar side, also, is developed from a distinct tract of true cartilage, but soon loses its independence; it forms the plate on which some of the *primary quills* are fixed.

Further on, on the ulnar side, near the small well-developed ungual phalanx of the embryo, but later, after hatching, a small oval cartilage appears, and *is ossified independently*.

A similar tract of cartilage is formed on the pollex or first digit, also, but is somewhat smaller than that on the second; it is on the ulnar side and near the ungual phalanx.

In the feeble third digit I only find a rudimentary secondary metacarpal, on the ulnar side; this is very constant throughout the *Carinatæ;* and sometimes, as I have already mentioned, there is a small rudiment of a second phalanx on that digit which, in the Lizard, has *four* phalanges.*

In seeking for evidence of the manner in which these high and noble hot-blooded feathered forms arose from among the Archaic Reptilia, I think that something has been gained in what I have stated above.

The skull brings evidence of the same sort, during its development, and it is to ancient long-beaked forms, and not to modern short-faced types of Reptilia, that we must look for any near relationship of the Reptiles in the Birds.

In the Guillemot (*Uria troile*) I have satisfied myself that there has been a considerable amount of *secular* shortening of the beak (rostrum and fore part of mandibles), and if we look at Dr. Marsh's figures of *Hesperornis* and *Ichthyornis* we shall see what long bills these toothed birds possessed.

* The figures of these parts, and also of the rest of the developing skeleton in these birds—Ducks, Auks, Guillemots, &c.—are ready for publication.

But there is no part of a developing bird's skeleton that is not rich with suggestive facts of this kind, as I propose to show in due time.

Presents, January 19, 1888.

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